

**UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

LIONRA TECHNOLOGIES LIMITED,

Plaintiff,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.

Defendants.

Case No. 2:22-cv-00100

JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Lionra Technologies Limited (“Lionra”) files this complaint against Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Samsung” or “Defendants”), alleging infringement of U.S. Patent No. 7,260,141. The Accused Products are mobile devices and base stations that support 5G cellular communications, made, used, offered for sale, sold, imported by Defendant in the United States and supplied by Defendants to their customers and integrated into electronic devices sold in the United States.

Plaintiff Lionra and the Patents-in-Suit

1. Plaintiff Lionra is a technology licensing company organized under the laws of Ireland, with its headquarters at The Hyde Building, Suite 23, The Park, Carrickmines, Dublin 18, Ireland.
2. Lionra is the owner of U.S. Patent No. 7,260,141, entitled “Integrated Beamformer/Modem Architecture,” which issued August 21, 2007 (the “’141 patent”). A copy of the ’141 patent is attached to this complaint as Exhibit 1.

Defendant and the Accused Products

3. On information and belief, Defendant Samsung Electronics Co., Ltd. (“SEC”) is a corporation organized under the laws of South Korea, with its principal place of business at 129, Samsung-Ro, YeongTong-Gu, Suwon-Si, Gyonggi-Do, 443-742, South Korea.

4. On information and belief, Defendant Samsung Electronics America, Inc. (“SEA”) is a United States corporation organized under the laws of the State of New York, with its principal place of business at 85 Challenger Road, Ridgefield Park, New Jersey 07660 and with an office located at an office located at 6625 Excellence Way, Plano, Texas 75023. SEA is a wholly-owned subsidiary of SEC. SEA distributes certain Samsung consumer electronics products, including the Accused Products, in the United States.

5. The Accused Products are mobile devices and base stations that support 5G cellular ultra-wideband communications, made, used, offered for sale, sold, imported by Defendants in the United States, including without limitation the Samsung 5G Galaxy S10, S20, S21, S22, Z Flip, Z Fold, and Tab S8+ mobile phones and tablet devices and the Samsung 5G NR radio base stations.

Jurisdiction and Venue

6. This action arises under the patent laws of the United States, Title 35 of the United States Code. This Court has original subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

7. This Court has personal jurisdiction over Defendants in this action because Defendants have established minimum contacts with the United States as a whole such that the exercise of jurisdiction would not offend traditional notions of fair play and substantial justice. Defendants have purposefully directed activities at the United States, in particular, directing Accused Products for sale to customers and distributors within the United States (including within this District) and

engaging in sales and marketing efforts to generate and support such sales. Defendants have committed acts of infringement of Lionra's patents giving rise to this action, such as by supplying to distributors and consumer device retailers the Accused Products in this District, including without limitation the Samsung 5G Galaxy S10, S20, S21, S22, Z Flip, Z Fold, and Tab S8+ mobile phones and tablet devices and the Samsung 5G NR radio base stations, each accused of infringement in this case. Defendants, directly and through subsidiaries, intermediaries, and third parties, have committed and continue to commit acts of infringement in this District by, among other things, making, using, offering to sell, selling, and importing products that infringe the '141 patent.

8. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400(b). Defendant SEC is a foreign corporation. Venue is proper as to a foreign defendant in any district. 28 U.S.C. § 1391(c)(3). Defendant SEA has committed acts of infringement in this District and has regular and established places of business in this District, including its office located at 6625 Excellence Way, Plano, Texas 75023.

9. Venue is proper in this district under 28 U.S.C. §1400(b) and 28 U.S.C. §§ 1391(c). Defendants have regular and established places of business in this district as set forth above.

Count 1 – Claim for infringement of the '141 patent.

10. Lionra incorporates by reference each of the allegations in paragraphs 1–9 above and further alleges as follows:

11. On August 21, 2007, the United States Patent and Trademark Office issued U.S. Patent No. 7,260,141, entitled "Integrated Beamformer/Modem Architecture." Ex. 1.

12. Lionra is the owner of the '141 patent with full rights to pursue recovery of royalties for damages for infringement, including full rights to recover past and future damages.

13. Each claim of the '141 patent is valid, enforceable, and patent-eligible.

14. Lionra and its predecessors in interest have satisfied the requirements of 35 U.S.C. § 287(a) with respect to the '141 patent, and Lionra is entitled to damages for Defendants' past infringement.

15. Defendants have directly infringed (literally and equivalently) and induced others to infringe the '141 patent by making, using, selling, offering for sale, or importing products that infringe the claims of the '141 patent and by inducing others to infringe the claims of the '141 patent without a license or permission from Lionra. These products include without limitation the Samsung 5G Galaxy S10, S20, S21, S22, Note 20, Z Flip, Z Fold, and Tab S8+ mobile phones and tablet devices and the Samsung 5G NR radio base stations, which infringe at least claim 1 of the '141 patent.

16. On information and belief, the Accused Products include an “apparatus for modulating and demodulating signals transmitted and received via an electronically steerable phased array antenna comprising a plurality of antenna elements.”

17. For example, 5G NR signals must be modulated and demodulated:

5.4 Modulation and upconversion

Modulation and upconversion to the carrier frequency f_0 of the complex-valued OFDM baseband signal for antenna port p , subcarrier spacing configuration μ , and OFDM symbol l in a subframe assumed to start at $t = 0$ is given by

- for PRACH

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0 t}\right\}$$

- for RIM-RS

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0^{\text{RIM}}(t-t_{\text{start},l_0}^{\mu}-N_{\text{CP}}^{\text{RIM}}T_c)}\right\}$$

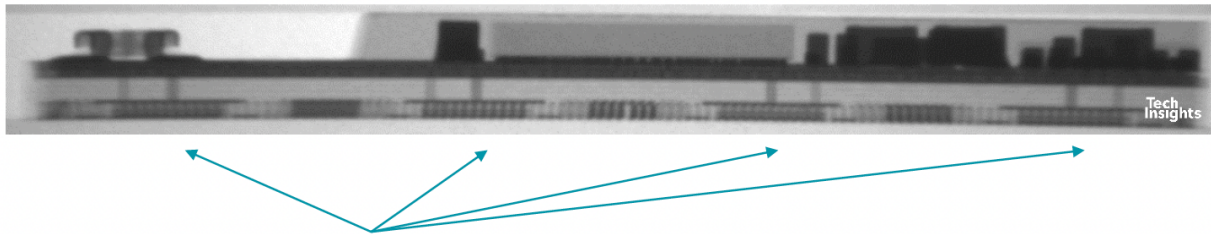
where f_0^{RIM} is the configured reference point for RIM-RS;

- for all other channels and signals

$$\text{Re}\left\{s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0(t-t_{\text{start},l}^{\mu}-N_{\text{CP}}^{\mu}T_c)}\right\}$$

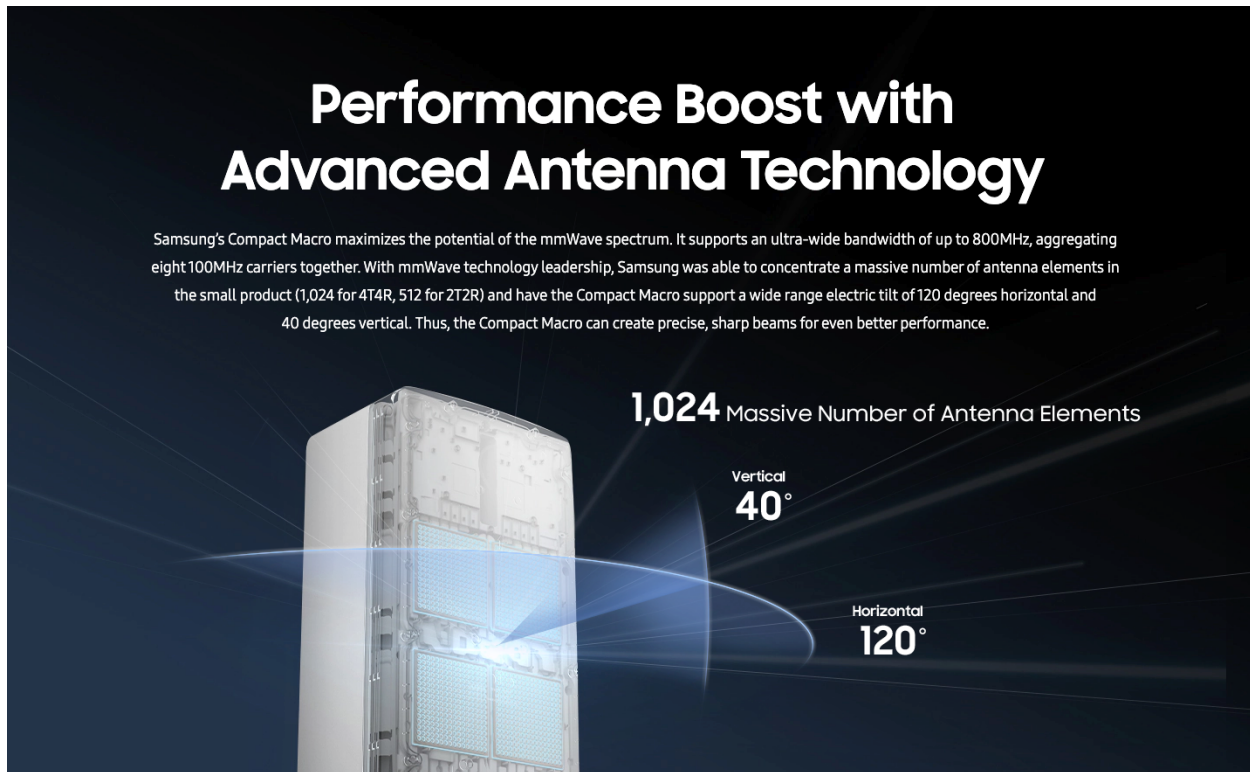
(3GPP TS 38.211 V16.8.0, § 5.4.)

18. As a further example, on information and belief the Galaxy S10 5G contains the Qualcomm QTM052 electronically steerable phased array antenna:



Antenna array integrated in to the bottom layers of the PWB.

19. As a further example, the Samsung Compact Macro 5G NR radio base station contains an electronically steerable phased array antenna:



(<https://www.samsung.com/global/business/networks/products/radio-access/access-unit/>)

20. On information and belief, the Accused Products include “a baseband modulator configured to modulate outbound digital baseband signals to be transmitted via the phased array antenna”:

5.4 Modulation and upconversion

Modulation and upconversion to the carrier frequency f_0 of the complex-valued OFDM baseband signal for antenna port p , subcarrier spacing configuration μ , and OFDM symbol l in a subframe assumed to start at $t = 0$ is given by

- for PRACH

$$\text{Re}\{s_l^{(p,\mu)}(t)e^{j2\pi f_0 t}\}$$

- for RIM-RS

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0^{\text{RIM}}(t-t_{\text{start},l_0}^{\mu}-N_{\text{CP}}^{\text{RIM}}T_c)}\right\}$$

where f_0^{RIM} is the configured reference point for RIM-RS;

- for all other channels and signals

$$\text{Re}\left\{s_l^{(p,\mu)}(t)\cdot e^{j2\pi f_0(t-t_{\text{start},l}^{\mu}-N_{\text{CP}}^{\mu}T_c)}\right\}$$

(3GPP TS 38.211 V16.8.0, § 5.4.)

7.3.1.5 Mapping to virtual resource blocks

The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols $y^{(p)}(0), \dots, y^{(p)}(M_{\text{symb}}^{\text{ap}} - 1)$ conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with $y^{(p)}(0)$ to resource elements $(k', l)_{p,\mu}$ in the virtual resource blocks assigned for transmission which meet all of the following criteria:

- they are in the virtual resource blocks assigned for transmission;
- the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];

(3GPP TS 38.211 V16.8.0, § 7.3.1.5.)

21. On information and belief, the Accused Products include “a baseband demodulator configured to demodulate incoming digital baseband signals generated from signals received via the phased array antenna.”

5.4 Modulation and upconversion

Modulation and upconversion to the carrier frequency f_0 of the complex-valued OFDM baseband signal for antenna port p , subcarrier spacing configuration μ , and OFDM symbol l in a subframe assumed to start at $t = 0$ is given by

- for PRACH

$$\text{Re}\{s_l^{(p,\mu)}(t)e^{j2\pi f_0 t}\}$$

- for RIM-RS

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0^{\text{RIM}}(t-t_{\text{start},l_0}^{\mu}-N_{\text{CP}}^{\text{RIM}}T_c)}\right\}$$

where f_0^{RIM} is the configured reference point for RIM-RS;

- for all other channels and signals

$$\text{Re}\left\{s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0(t-t_{\text{start},l}^{\mu}-N_{\text{CP}}^{\mu}T_c)}\right\}$$

(3GPP TS 38.211 V16.8.0, § 5.4.)

6.2 Physical resources

The frame structure and physical resources the UE shall use when transmitting in the uplink transmissions are defined in Clause 4.

The following antenna ports are defined for the uplink:

- Antenna ports starting with 0 for demodulation reference signals for PUSCH
- Antenna ports starting with 1000 for SRS, PUSCH
- Antenna ports starting with 2000 for PUCCH
- Antenna port 4000 for PRACH

If PUSCH repetition Type B as described in clause 6.1 of [6, TS38.214] is applied to a physical channel, the UE transmission shall be such that the channel over which a symbol on the antenna port used for uplink transmission is conveyed can be inferred from the channel over which another symbol on the same antenna port is conveyed if the two symbols correspond to the same actual repetition of a PUSCH transmission with repetition Type B.

(3GPP TS 38.211 V16.8.0, § 6.2.)

22. On information and belief, the Accused Products include “a shared baseband processor configured to receive digital baseband signals including the modulated outbound digital baseband signals and the incoming digital baseband signals, said shared baseband processor applying a single phase adjustment to each of the digital baseband signals to jointly account for both beamforming phase rotation and carrier phase rotation of individual antenna elements”:

Massive multi-input multi-output (MIMO) is a major breakthrough technology that improves the capacity and user experience of 5G eMBB. Instead of broadcasting data throughout the entire coverage area, the massive MIMO system concentrates the signal energy to a specific user, resulting in significant improvement of throughput and efficiency. This characteristic not only increases the downlink (DL) and uplink (UL) signal strength but also enhances the cell throughput by allocating multiple beams to one or multiple users. The spatially optimized signal can minimize its interference toward other users and/or adjacent cells and reduces interference levels of the entire network, especially in interference limited cell deployments [1-2].

A user-specific beam is transmitted toward the individual receive antenna of the user through a BF weight vector, which is defined as a steering vector toward the user's direction in line-of-sight (LOS) condition or a maximal ratio transmission vector in a non-LOS environment. In the case of LOS, the array gain is equal to the number of subarrays.

(https://images.samsung.com/is/content/samsung/assets/global/business/networks/insights/white-papers/1208_massive-mimo-for-new-radio/MassiveMIMOforNRTechnicalWhitePaper-v1.2.0.pdf at 1, 4)

5.3 OFDM baseband signal generation

5.3.1 OFDM baseband signal generation for all channels except PRACH and RIM-RS

The time-continuous signal $s_l^{(p,\mu)}(t)$ on antenna port p and subcarrier spacing configuration μ for OFDM symbol $l \in \{0, 1, \dots, N_{\text{slot}}^{\text{subframe}, \mu} N_{\text{symb}}^{\text{slot}} - 1\}$ in a subframe for any physical channel or signal except PRACH is defined by

$$s_l^{(p,\mu)}(t) = \begin{cases} \tilde{s}_l^{(p,\mu)}(t) & t_{\text{start},l}^{\mu} \leq t < t_{\text{start},l}^{\mu} + T_{\text{symb},l}^{\mu} \\ 0 & \text{otherwise} \end{cases}$$

$$\tilde{s}_l^{(p,\mu)}(t) = \sum_{k=0}^{N_{\text{grid},x}^{\text{size},\mu} N_{\text{sc}}^{\text{RB}} - 1} a_{k,l}^{(p,\mu)} e^{j2\pi \left(k + k_0^{\mu} - N_{\text{grid},x}^{\text{size},\mu} N_{\text{sc}}^{\text{RB}} / 2 \right) \Delta f (t - N_{\text{CP},l}^{\mu} T_c - t_{\text{start},l}^{\mu})}$$

$$k_0^{\mu} = \left(N_{\text{grid},x}^{\text{start},\mu} + N_{\text{grid},x}^{\text{size},\mu} / 2 \right) N_{\text{sc}}^{\text{RB}} - \left(N_{\text{grid},x}^{\text{start},\mu_0} + N_{\text{grid},x}^{\text{size},\mu_0} / 2 \right) N_{\text{sc}}^{\text{RB}} 2^{\mu_0 - \mu}$$

$$T_{\text{symb},l}^{\mu} = (N_u^{\mu} + N_{\text{CP},l}^{\mu}) T_c$$

where $t = 0$ at the start of the subframe.

(3GPP TS 38.211 V16.8.0, § 5.3.1.)

5.4 Modulation and upconversion

Modulation and upconversion to the carrier frequency f_0 of the complex-valued OFDM baseband signal for antenna port p , subcarrier spacing configuration μ , and OFDM symbol l in a subframe assumed to start at $t = 0$ is given by

- for PRACH

$$\text{Re}\{s_l^{(p,\mu)}(t)e^{j2\pi f_0 t}\}$$

- for RIM-RS

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0^{\text{RIM}}(t-t_{\text{start},l_0}^{\mu}-N_{\text{CP}}^{\text{RIM}}T_c)}\right\}$$

where f_0^{RIM} is the configured reference point for RIM-RS;

- for all other channels and signals

$$\text{Re}\left\{s_l^{(p,\mu)}(t)e^{j2\pi f_0(t-t_{\text{start},l}^{\mu}-N_{\text{CP}}^{\mu}T_c)}\right\}$$

(3GPP TS 38.211 V16.8.0, § 5.4.)

6.3.3.2 Mapping to physical resources

The preamble sequence shall be mapped to physical resources according to

$$a_k^{(p,\text{RA})} = \beta_{\text{PRACH}} y_{u,v}(k) \\ k = 0, 1, \dots, L_{\text{RA}} - 1$$

where β_{PRACH} is an amplitude scaling factor in order to conform to the transmit power specified in [5, TS38.213], and $p = 4000$ is the antenna port. Baseband signal generation shall be done according to clause 5.3 using the parameters in Table 6.3.3.1-1 or Table 6.3.3.1-2 with \bar{k} given by Table 6.3.3.2-1.

...

For operation with shared spectrum channel access, for $L_{\text{RA}} = 139$, a UE expects to be provided with higher-layer parameter *msg1-FrequencyStart* or *msgA-RO-FrequencyStart* if configured, and higher-layer parameter *msg1-FDM* or *msgA-RO-FDM* if configured, such that a random access preamble is confined within a single RB set. The UE assumes that the RB set is defined as when the UE is not provided *intraCellGuardBandsPerSCS* for an UL carrier as described in Clause 7 of [6, TS 38.214].

For operation with shared spectrum channel access, for $L_{\text{RA}} = 571$ or 1151 and Type-2 random access, a UE expects to be provided with higher-layer parameter *msgA-RO-FDM* equals to one.

(3GPP TS 38.211 V16.8.0, § 6.3.3.2.)

For operation with shared spectrum channel access where a UE is performing uplink transmission with configured grants in contiguous OFDM symbols on all resource blocks of an RB set, for the first such UL transmission the UE determines a duration of a cyclic prefix extension T_{ext} to be applied for transmission according to [4, TS 38.211] where the index for Δ_l [4, TS 38.211] is chosen randomly from a set of values configured by higher layers according to the following rule:

- If the first such UL transmission is within a channel occupancy initiated by the gNB (defined in Clause 4 of [16, TS 37.213]), the set of values is determined by *cg-StartingFullBW-InsideCOT*;
- otherwise, the set of values is determined by *cg-StartingFullBW-OutsideCOT*.

For operation with shared spectrum channel access where a UE is performing uplink transmission with configured grants in contiguous OFDM symbols on fewer than all resource blocks of an RB set, for the first such UL transmission the UE determines a duration of a cyclic prefix extension T_{ext} to be applied for transmission according to [4, TS 38.211] according to the following rule:

- If the first such UL transmission is within a channel occupancy initiated by the gNB (defined in Clause 4 of [16, TS 37.213]), the index for Δ_i [4, TS 38.211] is equal to *cg-StartingPartialBW-InsideCOT*;
- otherwise, the index for Δ_i [4, TS 38.211] is equal to *cg-StartingPartialBW-OutsideCOT*.

(3GPP TS 38.214 V16.8.0, § 6.1.2.3.)

9.2.4 Measurements

In RRC_CONNECTED, the UE measures multiple beams (at least one) of a cell and the measurements results (power values) are averaged to derive the cell quality. In doing so, the UE is configured to consider a subset of the detected beams. Filtering takes place at two different levels: at the physical layer to derive beam quality and then at RRC level to derive cell quality from multiple beams. Cell quality from beam measurements is derived in the same way for the serving cell(s) and for the non-serving cell(s). Measurement reports may contain the measurement results of the X best beams if the UE is configured to do so by the gNB.

(3GPP TS 38.300 V16.8.0, § 9.2.4.)

If the procedure in [6, TS 38.214] indicates that phase-tracking reference signals are being used, the block of complex-valued symbols $x^{(0)}(0), \dots, x^{(0)}(M_{\text{symbol}}^{\text{layer}} - 1)$ shall be divided into sets, each set corresponding to one OFDM symbol, and where set l contains $M_{\text{sc}}^{\text{PUSCH}} - \varepsilon_l N_{\text{samp}}^{\text{group}} N_{\text{group}}^{\text{PTRS}}$ symbols and is mapped to the complex-valued symbols $\tilde{x}^{(0)}(lM_{\text{sc}}^{\text{PUSCH}} + i')$ corresponding to OFDM symbol l prior to transform precoding, with $i' \in \{0, 1, \dots, M_{\text{sc}}^{\text{PUSCH}} - 1\}$ and $i' \neq m$. The index m of PT-RS samples in set l , the number of samples per PT-RS group $N_{\text{samp}}^{\text{group}}$, and the number of PT-RS groups $N_{\text{group}}^{\text{PTRS}}$ are defined in clause 6.4.1.2.2.2. The quantity $\varepsilon_l = 1$ when OFDM symbol l contains one or more PT-RS samples, otherwise $\varepsilon_l = 0$.

(3GPP TS 38.211 V16.8.0, § 6.3.1.4.)

6.4.1.2.2 Mapping to physical resources

6.4.1.2.2.1 Precoding and mapping to physical resources if transform precoding is not enabled

The UE shall transmit phase-tracking reference signals only in the resource blocks used for the PUSCH, and only if the procedure in [6, TS 38.214] indicates that phase-tracking reference signals are being used.

The PUSCH PT-RS shall be mapped to resource elements according to

$$\begin{bmatrix} a_{k,l}^{(p_0, \mu)} \\ \vdots \\ a_{k,l}^{(p_{p-1}, \mu)} \end{bmatrix} = \beta_{\text{PT-RS}} W \begin{bmatrix} r^{(\tilde{p}_0)}(2n + k') \\ \vdots \\ r^{(\tilde{p}_{v-1})}(2n + k') \end{bmatrix}$$

$$k = \begin{cases} 4n + 2k' + \Delta & \text{configuration type 1} \\ 6n + k' + \Delta & \text{configuration type 2} \end{cases}$$

(3GPP TS 38.211 V16.8.0, § 7.4.1.2.)

7.4.1.2 Phase-tracking reference signals for PDSCH

7.4.1.2.1 Sequence generation

The phase-tracking reference signal for subcarrier k is given by

$$r_k = r(2m+k')$$

where $r(2m+k')$ is the demodulation reference signal given by clause 7.4.1.1.2 at position l_0 and subcarrier k

7.4.1.2.2 Mapping to physical resources

The UE shall assume phase-tracking reference signals being present only in the resource blocks used for the PDSCH, and only if the procedure in [6, TS 38.214] indicates phase-tracking reference signals being used.

If present, the UE shall assume the PDSCH PT-RS is scaled by a factor $\beta_{\text{PT-RS},i}$ to conform with the transmission power specified in clause 4.1 of [6, TS 38.214] and mapped to resource elements $(k, l)_{p,\mu}$ according to

$$a_{k,l}^{(p,\mu)} = \beta_{\text{PT-RS},i} r_k$$

(3GPP TS 38.211 V16.8.0, § 7.4.1.2.)

Jury Trial Demanded

23. Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Lionra requests a trial by jury of any issues so triable by right.

Prayer for Relief

Plaintiff Lionra respectfully requests the following relief from this Court:

- A. A judgment in favor of Lionra that Defendants have infringed the '141 patent and that the '141 patent is valid, enforceable, and patent-eligible;
- B. A judgment and order requiring Defendants to pay Lionra compensatory damages, costs, expenses, and pre- and post-judgment interest for its infringement of the '141 patent, as provided under 35 U.S.C. § 284;
- C. A permanent injunction prohibiting Defendants from further acts of infringement of the '141 patent;
- D. A judgment and order requiring Defendants to provide an accounting and to pay supplemental damages to Lionra, including, without limitation, pre-judgment and post-judgment interest;
- E. A finding that this case is exceptional under 35 U.S.C. § 285, and an award of Lionra's reasonable attorney's fees and costs; and

F. Any and all other relief to which Lionra may be entitled.

Dated: April 1, 2022

/s/ Reza Mirzaie

Reza Mirzaie

CA State Bar No. 246953

Marc A. Fenster

CA State Bar No. 181067

Neil A. Rubin

CA State Bar No. 250761

RUSS AUGUST & KABAT

12424 Wilshire Boulevard, 12th Floor

Los Angeles, CA 90025

Telephone: 310-826-7474

Email: mfenster@raklaw.com

Email: rmirzaie@raklaw.com

Email: nrubin@raklaw.com

**ATTORNEYS FOR PLAINTIFF,
LIONRA TECHNOLOGIES LIMITED**